PATENT ABSTRACTS OF JAPAN

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(54) VACUUM ULTRAVIOLET-EXCITED LIGHT-EMITTING ELEMENT

(57)Abstract:
PURPOSE: To reduce aged deterioration of a light-emitting element in luminosity and in color so as to enhance its life by using in the light-emitting element a barium-magnesium-aluminate phosphor represented by a specific formula.
CONSTITUTION: A barium-magnesium-aluminate phosphor represented by the composition formula Ba1-xEwxMgAl10O17 is employed in a light-emitting element. In the formula, (x) is 0.05 to 0.5. The barium-magnesium-aluminate phosphor, which is a blue-light-emitting phosphor for use in a full-color plasma display panel, greatly varies in its life characteristic depending on its composition, and aged deterioration of luminosity and changes in color with time are reduced by use of the composition represented by the formula.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to the vacuum-ultraviolet-rays excited light element which has the structure which excites by vacuum ultraviolet rays and is made to emit light about a vacuum-ultraviolet-rays excited light element using a more detailed specific fluorescent substance.
[0002]
[Description of the Prior Art]In recent years, development of the vacuum-ultraviolet-rays excited light element which has the structure of exciting a fluorescent substance and making it emitting light by the vacuum ultraviolet rays emitted by rare gas discharge is performed briskly. The example is development of a plasma-display panel (henceforth "PDP"). PDP is the display device which arranges and constituted much narrow discharge space (henceforth a "display cell") in matrix form, The discharge electrode is provided in each display cell, the fluorescent substance is applied to the wall of each display cell, and rare gas, such as helium-Xe, Ne-Xe, and Ar, is enclosed with the inside of each display cell. By impressing voltage to an electrode, in a display cell, rare gas discharge happens and vacuum ultraviolet rays are emitted. A fluorescent substance is excited by these vacuum ultraviolet rays, and visible light is emitted. A picture is displayed by luminescence of the fluorescent substance of the display cell of the prescribed position of a display device. A full color display can be performed by distinguishing these by different color with to matrix form, using respectively red and the fluorescent substance which emits light blue or green as a fluorescent substance used for each display cell. This is full color PDP.
[0003]As a red light fluorescent substance (Y, Gd), conventionally By the way, BO_3:Eu, full color PDP which uses $BaMgAl_{14}O_{23}$:Eu etc. as Zn_2SiO_4:Mn and a blue light fluorescent substance as a green emission fluorescent substance has put in practical use (the volume on Nikkei micro device "flat-panel display" -- in 1994.) Refer to Nikkei BP issue.
[0004]
[Problem(s) to be Solved by the Invention]However, in order to raise the characteristic of full color PDP, the luminous efficiency of a fluorescent substance and improvement in a life are desired, Compared with the red light fluorescent substance of others [Eu / of a blue light fluorescent substance / especially / $BaMgAl_{14}O_{23}$:], and a green emission fluorescent substance, degradation of light emitting luminance with the passage of time is large, and also since it has the fault of carrying out aging also of the luminescent color, improvement in a life is desired strongly.
[0005]This invention is made in view of the above-mentioned situation, and is a thing. The purpose is to provide the vacuum-ultraviolet-rays excited light element which controlled degradation of the light emitting luminance of ** with the passage of time, and aging of the luminescent color.

[0006]
[Means for Solving the Problem]A result in which this invention persons considered

wholeheartedly a presentation of a barium magnesium aluminate phosphor ($BaMgAl_{14}O_{23}$:Eu) which is a blue light fluorescent substance for full color PDP currently used from the former, The life characteristic of a fluorescent substance changes a lot with the presentation, PDP using a barium magnesium aluminate phosphor of a specific presentation as a blue light fluorescent substance found out that both degradation of light emitting luminance with the passage of time and aging of the luminescent color were improved compared with PDP using the conventional $BaMgAl_{14}O_{23}$:Eu fluorescent substance, and completed this invention.

[0007]Namely, in a vacuum-ultraviolet-rays excited light element with which a vacuum-ultraviolet-rays excited light element of this invention seals hermetically in a container a fluorescent substance and a discharge electrode which emit light by gas which has a discharge emission spectrum to a vacuum-ultraviolet-rays field, and vacuum-ultraviolet-rays excitation, A barium magnesium aluminate phosphor expressed with empirical formula $Ba_{1-x}Eu_xMgAl_{10}O_{17}$ (however, x is a number which fulfills becoming conditions 0.05 <=x<=0.5) is used.

[0008]It is an activator of this fluorescent substance. The concentration x of Eu is from a point of luminescence intensity. This invention is explained to the following with practically preferred it being a number which fulfills becoming conditions 0.05 <=x<=0.5 still in detail. A vacuum-ultraviolet-rays excited light element of this invention is manufactured like the conventional vacuum-ultraviolet-rays excited light element except using a barium magnesium aluminate phosphor manufactured, for example by a following method as a blue light fluorescent substance applied in a display cell.

[0009]A barium magnesium aluminate phosphor used by this invention is compoundable as follows, for example. As a fluorescent substance raw material, namely, barium compounds, such as (1) barium oxide, barium hydroxide, and barium carbonate, (2) Europium compounds, such as europium oxide, europium, fluoridation, (3) Magnesium compounds, such as magnesium oxide, magnesium hydroxide, and magnesium carbonate, And specified quantity weighing of the aluminium compounds, such as (4) aluminum oxides and aluminium hydroxide, is carried out, flux, such as barium fluoride, aluminum fluoride, and magnesium fluoride, is blended with this, and these raw material mixtures are fully mixed. Crucible is filled up with an obtained raw material mixture, and it is calcinated once or more over 2 to 40 hours in a reducing atmosphere at 1200-1700 **. There are a lump of a method of embedding crucible in which it filled up with a raw material mixture as a method of acquiring a reducing atmosphere, in crucible in which carbon was filled up, and black lead, a method of putting in carbon substances, such as a coconut shell, in crucible in which a raw material was filled up, etc. In order to make reduction nature more reliable, such crucibles may be calcinated in atmosphere of nitrogen or nitrogen-hydrogen. A steam may be contained in such atmosphere. A barium magnesium aluminate phosphor of blue light used by this invention can be obtained by processing distribution, rinsing, desiccation, sieving, etc. to fired material which finished calcination.

[0010]A barium magnesium aluminate phosphor manufactured by an above-mentioned method, For example, after applying and baking by thick film screen printing etc. to a display cell of PDP, a vacuum-ultraviolet-rays excited light element of this invention can be manufactured by carrying out hundreds Torr enclosure of the rare gas, such as gas which has a discharge emission spectrum to a vacuum-ultraviolet-rays field, for example,

helium-Xe, Ne-Xe, and Ar.
[0011]Below, an example explains this invention.
[0012]
[Example]
Example $BaCO_3$0.9 mol$Eu_2O_3$0.05 mol3$MgCO_3$ and $Mg(OH)_2$0.25 molAl_2O_3 (gamma type) Many raw materials of the 5.0 mol$AlF_3$0.01 mol above. It mixed in the above-mentioned quantity, and crucible was filled up, and also black lead was put on the raw material, and it calcinated primarily over 11 hours with the maximum temperature of 1450 ** including the rising-and-falling-temperature time from a room temperature in the nitrogen atmosphere which covered and contained the steam.
[0013]Next, black lead was removed, calcination powder was ground and sifted out, crucible was filled up again, and secondary calcination was performed over 11 hours with the maximum temperature of 1450 ** including the rising-and-falling-temperature time from a room temperature in the nitrogen-hydrogen mixed atmosphere which covered and contained the steam. Subsequently, distribution, washing, desiccation, and processing of sieving were performed to calcination powder, and the empirical formula obtained the divalent europium activation blue light barium magnesium aluminate phosphor expressed with $Ba_{0.9}Eu_{0.1}MgAl_{10}O_{17}$.
[0014]Thick film screen printing of this fluorescent substance was carried out to the cell of 0.7 mm of cell pitches, it baked for 10 minutes at 515 **, 300 Torr enclosure of the rare gas of helium-Xe (10% of content of Xe) was carried out into the cell, and the vacuum-ultraviolet-rays excited light element of this invention was obtained. The vacuum-ultraviolet-rays excited light element of obtained this invention Thus, the constant current of 100microA, Duty = when light was made to drive and emit by 1/60 and the luminescent color and light emitting luminance at the time of a drive start were measured with the luminance meter (TOPCON BM-5), the luminescent color (chromaticity coordinate of a CIE colorimetric system) was x= 0.124 and y= 0.080, and light emitting luminance was 21.6 cd/m^2.
[0015]Apart from this, the continuation drive of the obtained vacuum-ultraviolet-rays excited light element was carried out on the above-mentioned conditions, and aging of the radiant power output was measured using the photo-transistor. Correlation with the driving time of a vacuum-ultraviolet-rays excited light element and the radiant power output (relative value) which were obtained by this example is shown in drawing 1. Driving time until a radiant power output becomes half was 1091 minutes. When the luminescent color 1817 minutes after a drive start was measured, it is x= 0.131 and y= 0.095 and there was no change the time of a drive start and after 1817 hours with the big luminescent color.
[0016]Comparative example $BaCO_3$0.9 mol$Eu_2O_3$0.05 mol3$MgCO_3$ and $Mg(OH)_2$0.25 molAl_2O_3 (gamma type) Many raw materials of the 7.0 mol$AlF_3$0.014 mol above. Except using in the above-mentioned quantity (namely, mixture ratio stoichiometrically expressed with empirical formula $Ba_{0.9}Eu_{0.1}MgAl_{14}O_{23}$), it processed like the example and the divalent europium activation blue light barium magnesium aluminate phosphor was obtained.
[0017]Thus, the vacuum-ultraviolet-rays excited light element was manufactured like the example except using the obtained fluorescent substance. Thus, the vacuum-ultraviolet-rays excited light element of the acquired comparative example is driven like the case of

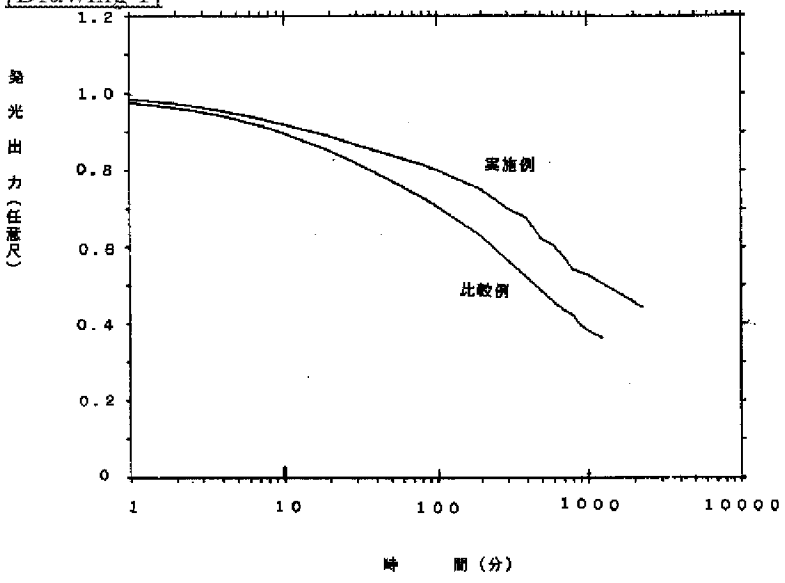
the vacuum-ultraviolet-rays excited light element of an example, When light was made to emit and the luminescent color and light emitting luminance at the time of a drive start were measured, the luminescent color (chromaticity coordinate of a CIE colorimetric system) was x= 0.130 and y= 0.093, and light emitting luminance was 22.1 cd/m^2.
[0018]Apart from this, the continuation drive of the vacuum-ultraviolet-rays excited light element of the acquired comparative example was carried out, and aging of light emitting luminance was measured like the above-mentioned example using the photo-transistor. Correlation with the driving time of a vacuum-ultraviolet-rays excited light element and the radiant power output (relative value) which were obtained by this comparative example is shown in drawing 1. Driving time until a radiant power output becomes half was 460 minutes, and was the time below half compared with the vacuum-ultraviolet-rays excited light element of an example. When the luminescent color 1231 minutes after a drive start was measured, it is x= 0.181 and y= 0.169 and the luminescent color was changing a lot compared with the early stages of a drive start.
[0019]
[Effect of the Invention]According to this invention, it is possible for a vacuum-ultraviolet-rays excited light element with little the fall of temporal light emitting luminance and change of the luminescent color to be obtained, and to provide the color PDP with a good life characteristic compared with the conventional thing.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a graph which illustrates aging of the light emitting luminance of the vacuum-ultraviolet-rays excited light element of this invention, and the conventional vacuum-ultraviolet-rays excited light element.

DRAWINGS

[Drawing 1]



CLAIMS

[Claim(s)]

[Claim 1]In a vacuum-ultraviolet-rays excited light element which seals hermetically in a container a fluorescent substance and a discharge electrode which emit light by gas which has a discharge emission spectrum to a vacuum-ultraviolet-rays field, and vacuum-ultraviolet-rays excitation, A vacuum-ultraviolet-rays excited light element, wherein a barium magnesium aluminate phosphor expressed with empirical formula $Ba_{1-x}Eu_xMgAl_{10}O_{17}$ (however, x is a number which fulfills becoming conditions $0.05 <= x <= 0.5$) is used.